

Does the Availability of a Disease Management Clinic  
Reduce Hospital Use for Atrial Fibrillation Emergency  
Visits?

by

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## **Introduction**

The prevalence of atrial fibrillation (AFib) was estimated in 2005 to affect 3.03 million Americans, and its impact will rise because AFib prevalence increases with age (Go et al., 2001; Naccarelli et al., 2009). One study matched a cohort of AFib patients to comparable patients not diagnosed with AFib and found that direct medical costs over the next year were \$8,705 more for patients with an AFib diagnosis (Kim et al., 2011). Many AFib patients typically present at the emergency department (ED) for treatment; while patients with severe forms of AFib or comorbidities require hospitalization, patients with low or moderate risk AFib are often unnecessarily hospitalized. Furthermore, two-thirds of chronic AFib patients return within six months of a prior ED visit or hospitalization (Kim, Hussein et al., 2009), and new onset AFib patients who are not adequately treated or trained about their condition after leaving the ED may be readmitted in the hospital within a year of their first visit. These resulting rehospitalizations increase the cost burden on healthcare payers as well as the patients themselves.

In an attempt to address these rising costs, healthcare facilities are turning to disease management clinics as a way to help AFib patients manage their condition. By educating patients on their drugs, treatment regimens, therapy options, and rate and rhythm control strategies, AFib patients could be better equipped to maintain their condition from home and reduce the likelihood of future hospitalizations or ED visits. These programs have the potential to result in reduced hospital expenditures and fewer ED visits. The purpose of this analysis is to evaluate the effectiveness of a disease management clinic (the AFib Transitions Clinic) initiated at UNC Hospitals in July 2015 targeting low- and moderate-risk AFib patients. In particular, this analysis will estimate how the rate of hospital use by AFib patients (either during the initial ED visit or on a return ED visit) was changed by the availability of the Transitions Clinic compared to use before the implementation of the Transitions Clinic.

## **Background**

### **Atrial Fibrillation**

Atrial fibrillation (AFib) is a condition of arrhythmia that affects the atrial chambers of the heart; with AFib, the two chambers receiving circulated blood do not pump regularly, resulting in an overall rapid and irregular heartbeat for affected patients. The majority of patients with the disease show no symptoms, but patients who show symptoms typically present to the ED. Diagnosis requires the use of an echocardiogram or other similar machine. AFib has four general categories based on severity, ranging from a single episode of paroxysmal AFib (when symptoms last less than 7 days and are self-terminating), to the more chronic or unmanaged severity of permanent AFib. Many AFib patients present with other chronic conditions, typically hypertensive heart disease, valvular heart disease, coronary heart disease, and, most often, heart failure (Krahn et al., 1995, Wong 2000, Cha et al 2004).

Treatment for AFib often depends on whether the patient has new onset AFib or if the patient has been diagnosed previously and treated for AFib (even for paroxysmal AFib). Both new onset and chronic AFib patients require access to anticoagulant drugs, and, in many cases, antiarrhythmic drugs and rate monitors. Patients and providers are advised to monitor the prescribed medications for their safety and efficacy, as well as the patient's health and functioning status. Many patients will need to return to their primary care provider or other clinic to evaluate any progress of the severity of their AFib, as well as ensure that the patients are receiving the correct dosage of their medications.

### **Disease Management Clinic**

As our society grows older and the prevalence of chronic conditions increases, hospitals and other providing facilities are establishing disease management clinics to address the need for patient monitoring and maintenance among those with at least one chronic condition. The idea behind disease management clinics and programs is to engage and educate the patient on their primary chronic

condition in order to provide more encompassing care and to address the patient and condition beyond acute care. A lead provider – typically a physician – would provide the main source of care at the clinic and design treatment regimens, while nurses and other mid-level practitioners would provide the disease education and self-management techniques, as well as help monitor the patient’s condition and treatment adherence.

While the concept of diseases management has been used for certain conditions in the past, hospitals and providers have broadened the scope and availability of these clinics as the system changes to emphasize value-based care (Congressional Budget Office, 2004). Though disease management clinics are most commonly used for specific conditions such as diabetes and chronic obstructive pulmonary disease, some providers are interested in applying the concept to patients with AFib; some evidence supports the use of disease management for AFib (Tran et al., 2012). Indeed, even for AFib patients who are at high risk for stroke and other associated diseases, a management service where health providers oversee patients’ drug dosage and maintenance led to better outcomes at lower cost (Roccaforte et al, 2005; Sullivan et al., 2006).

#### The AFib Transitions Clinic at UNC Hospital

The AFib Transitions Clinic (or Transitions Clinic) at UNC Hospital is housed under the emergency department (ED). Established in July 2015 by Dr. Anil Gehi and a group of providers at UNC Hospitals, the Transitions Clinic provides self-management training and techniques to AFib patients in addition to prescriptions and treatment regimens. The theory, based on evidence from similar clinics for other chronic diseases, is that if patients are empowered to fully understand their treatment regimens and manage their own care as much as they can, they can avoid future hospitalizations and AFib-related complications. Furthermore, if ED providers are aware of a disease management clinic targeting AFib patients that can enable patients without severe symptoms to better care for themselves, then ED

providers would feel more comfortable discharging these AFib patients from the ED and reduce unnecessary hospitalizations. Ideally, the clinic will save time and money for both payers, patients, and even some providers. Patients will benefit from both reduced health expenditures and increased time at home instead of the hospital.

To be admitted to the Transitions Clinic from the ED, the attending physician has to refer the patient after screening for AFib and other health conditions. The Transitions Clinic aims to capture AFib patients who can be treated and released from the ED without immediate hospitalization; that is, these patients do not have a severe form of AFib and no other comorbidities requiring hospitalization. If successful, the AFib Transitions Clinic would also reduce or at least not increase the need for return to the ED among these AFib patients. The Transitions Clinic provides referred patients with prescriptions, education on self-management techniques and what the treatment regimens require (e.g., how often to check on certain metrics), and scheduling of follow-up care.

The concept of “self-management” has been applied to other chronic conditions besides AFib, but the AFib Transitions Clinic represents the first self-management clinic in the UNC Hospital system based in Chapel Hill specifically targeting AFib patients (Sease et al., 2013; Dritsaki et al, 2016). Currently, the Transitions Clinic in Chapel Hill is a pilot program. Ultimately, the project team wants to establish additional AFib Transitions Clinics at other UNC Hospitals facilities and to evaluate the program using a randomized trial.

### **Research Question, Hypothesis, and Aims**

This study will investigate the effectiveness of the AFib Transitions Clinic at UNC Hospitals, which opened in July, 2015. My goal is to determine if the Transitions Clinic adjusted provider protocol regarding AFib diagnoses in the ED resulted in discharges rather than hospitalization and reduced 90-day return to the hospital among low- and moderate-risk AFib patients. The outcomes of effect are (1)

hospital admission at the index (initial) ED visit and (2) return to the ED within 90 days of the index ED visit. My goal is to determine if the clinic provided treatment at a lower burden to patients and society. Hospital admissions and ED visits are often reflective of one's condition and quality of disease management. Furthermore, if AFib-related hospitalizations and emergency visits are averted due to treatment in the Clinic, then healthcare payers may see cost savings. However, even if total costs per patient are not reduced by the AFib Clinic due to the cost of the clinic, reductions in hospital use can avoid unmeasured costs (e.g., anxiety, pain, or suffering) for patients.

My research consists of two aims:

*Specific Aim 1:* Compare characteristics of low/moderate risk patients before and after availability of the AFib Clinic in order to describe the clinic's target population and assess comparability of the comparison group selected from patients prior to the implementation of the Transitions Clinic.

*Specific Aim 2:* Estimate the differences in hospitalization and 90-day ED visits potentially attributable to the Transitions Clinic.

*Hypothesis: The AFib Transitions Clinic will result in fewer hospitalizations at the index ED visit and fewer 90-day returns to ED than the usual treatment pathway (as measured by comparing comparable patients in the pre- and post-implementation period).*

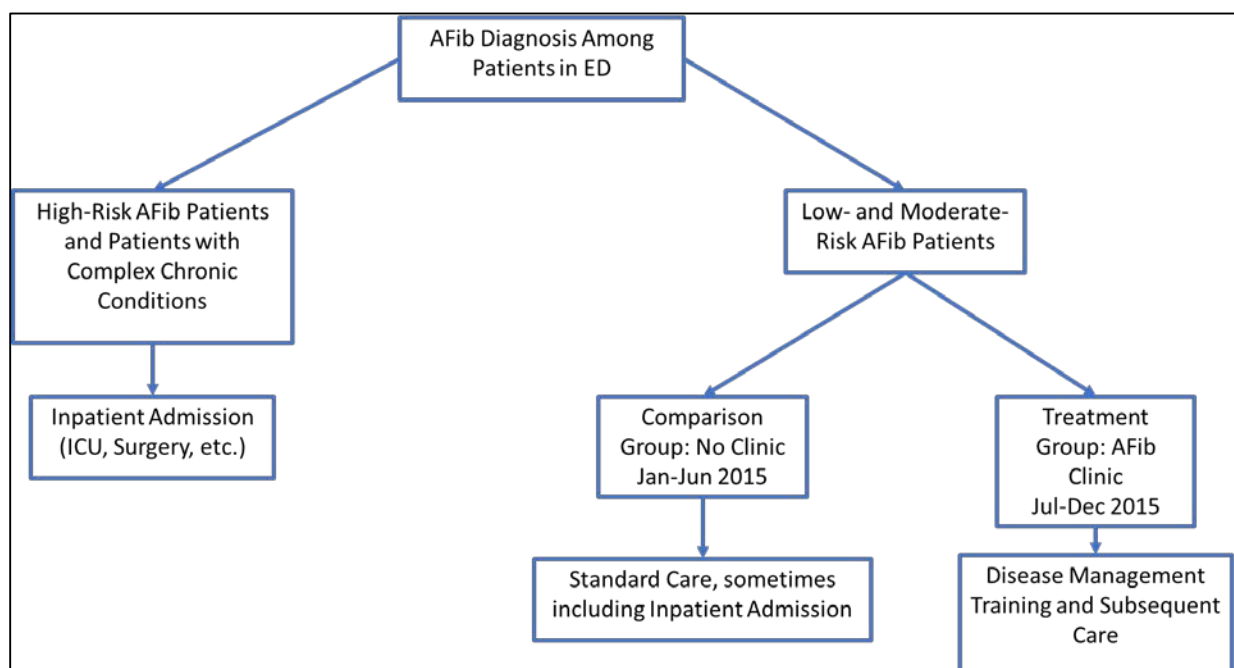
### **Study Design and Statistical Methods**

#### **Study Design**

The idea behind the clinic is to reduce the likelihood of inpatient admission for AFib at the time of the initial ED visit for AFib patients not requiring hospitalization, as well as future ED visits and hospital admissions related to AFib. If the clinic succeeds in empowering patients to manage their care, subsequent visits to the emergency department should decline. Figure 1 depicts the possible pathways

for patients presenting at the ED. Patients with uncomplicated AFib (e.g., low or moderate risk) and no complicating comorbidities are appropriate for clinic referral. In the absence of randomization for the pilot program, this study will estimate the hospital and subsequent ED use experience of the comparison patients using observational data on patients presenting at the ED with AFib prior to and after the clinic implementation.

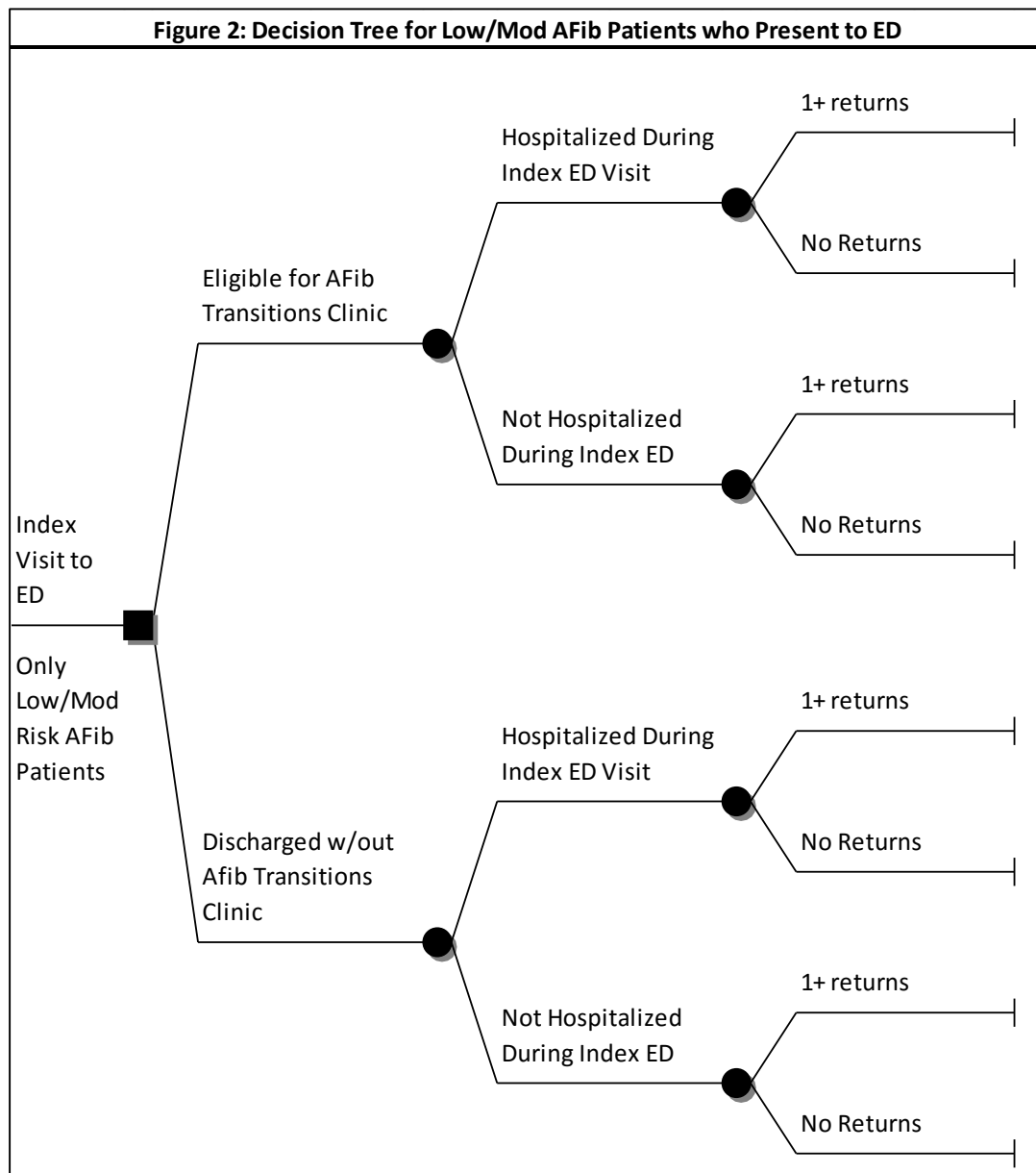
Figure 1: Conceptual Model for Study Design



I used logistic regressions to assess the characteristics of patients identified both before and after the implementation of the clinic as being suitable for the Transitions Clinic as well as the net impact of the clinic on outcomes. The outcomes are: 1) whether the patient was hospitalized at the index ED visit; and 2) whether a patient returned to the ED within 90 days of their index visit. All measures are calculated beginning with an AFib patient's index visit at the ED (i.e., low- and moderate-risk patients whose index ED visit was before the Transition Clinic started will be the comparison patients, and patients whose index ED visit was after July 1, 2015 will be the treatment patients).



Figure 2 presents a decision tree used to map the patients' movements through treatment pathways and the possible outcomes they experience. In the model, we only consider patients who are low- or moderate-risk; that is, AFib patients whose symptoms are not too severe to require hospitalization and can theoretically be discharged from the index ED if an ambulatory disease management clinic is available.



The parameter estimates required for the decision model before and after the AFib Clinic implementation include the likelihood of hospitalization at the time of the index ED visit and the likelihood of returning to the ED within three months of index visit.

### Data

I used observations collected by the AFib Transitions Clinic Project team, led by Dr. Anil Gehi and Dr. Kevin Biese, identified by whether they arrived before the implementation of the Clinic or after implementation. Included patients were identified by the date of their index visit. The pre-implementation data (index ED visits collected from January 1, 2015, to June 30, 2015) will reflect AFib treatment under the usual care pathway, and the post-implementation data (index ED visits collected from July 1, 2015, to December 31, 2015) will reflect treatment provided through the AFib Clinic. These timeframes are chosen to maximize respective sample sizes. My time horizon requires my focus on the patients' data from their index visit and during the three months following that visit.

Patients included in this analysis were patients who had a primary diagnosis of atrial fibrillation during their index ED visit and were identified through physician review of records to be appropriate for the Transitions Clinic (either before or after availability of the Transitions Clinic). Based on these criteria, I used 36 observations pre-implementation and 72 observations post-implementation.

Three outcome measures were analyzed as dependent variables in this analysis: 1) the likelihood of a patient being hospitalized during their index ED visit; 2) the likelihood of a patient returning to the hospital within 90 days of their index visit; and 3) the patient's combined ED/hospital use. To define combined ED/hospital use, a patient is coded as 1 for the last dependent variable if they had been hospitalized during their index ED visit, had returned to the ED within 90 days, and/or had been hospitalized on a return visit to the ED. The last dependent variable is used as a reflection of the whole patient experience with care; I hypothesized that the Transitions Clinic would reduce the

likelihood of index hospitalizations, return visits to the ED, and hospitalization on follow-up, among its visitors, since it would be considered an alternative to hospitalization. The key independent variable observed was whether the AFib Transitions Clinic was available at the time of the index ED visit.

### Statistical Methods

The analysis used logistic regressions run in Stata 12. Since this study is observational rather than randomized, it is important to control for other patient characteristics that could be associated with outcomes. All regressions controlled for by gender, age, whether the patient was insured by Medicare, and average SAF score. Information on other variables that might be associated with outcome (including income, marital status, or socio-economic status) were not available. The SAF score measures a patient's severity of AFib symptoms, with a higher number reflecting worse symptoms. This SAF score was used as a proxy for case mix in the sample. Equation 1 below displays the regression equation used for all dependent variables:

$$Eq\ 1: Outcome = \alpha + \beta_1 Treatment + \beta_2 SAF\ Score + \beta_3 Gender + \beta_4 Age + \beta_5 Medicare$$

### Results

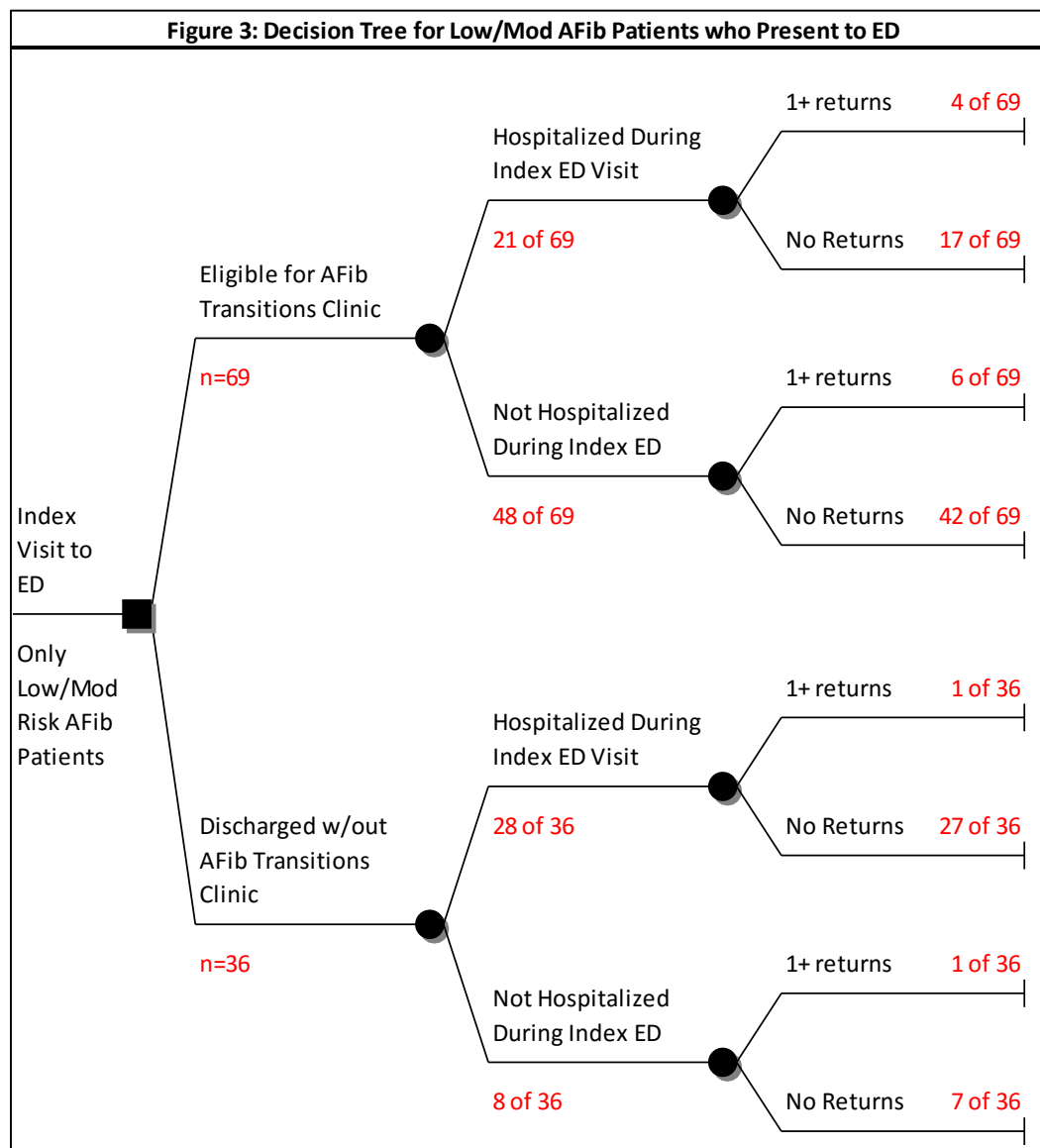
Table 1 displays the descriptive statistics of the independent and dependent variables for the comparison and treatment groups. Regarding the independent variables, the two groups are relatively comparable across these characteristics, despite differences in group size. None of the independent variables are significantly different for comparison versus patients based on bivariate t-tests. The mean age of the treatment group is slightly older (66.7 years) versus the comparison group (64.4 years). The treatment group has more patients identifying as white or Caucasian (87.3% versus 83.3%), though the comparison group has more patients identifying as female (47.2% versus 38.6%). The comparison patients have a higher average SAF score, indicating patients with worse AFib symptoms than those found in the treatment group. In addition, the comparison group has more patients with a primary

diagnosis of AFib on their index ED visit than those in the treatment group. Finally, the treatment group had more people covered by Medicare than the comparison group. Only one patient in the entire sample was uninsured, and insurance status was not mutually exclusive (e.g., a patient can list both private and Medicare as their primary forms of insurance).

<b>Table 1: Descriptive Statistics of Comparison and Treatment Groups</b>			
<b>Characteristic</b>	<b>Comparison (pre-period) group (n=36)</b>	<b>Treatment (post-period) group (n=69)</b>	<b>Univariate Test of Difference (p-value)</b>
<b>Average age (SD)</b>	64.4 (16.3)	66.6 (13.9)	0.48
<b>Female</b>	47.2%	39.1%	0.43
<b>White/Caucasian</b>	83.3%	88.4%	0.47
<b>Case Mix Severity - Average SAF score (SD)</b>	2.0 (0.8)	1.8 (1.0)	0.19
<b>Primary AFib Diagnosis</b>	97.2%	91.3%	0.25
<b>Medicare</b>	47.2%	59.4%	0.23
<b>Hospitalized at Index ED Visit</b>	77.7%	30.4%	0.00*
<b>Returned to Hospital Within 90 Days of Index ED Visit</b>	2.8%	14.5%	0.06
<b>Combined ED/Hospital Use</b>	80.6%	37.7%	0.00*

The treatment and comparison groups are distinctly different when observing the unadjusted distributions of the dependent variables. Figure 3 displays the unadjusted outcome results into the decision tree shown earlier. These results reflect the pathways for the dependent variables listed in the bottom of Table 1. The pre-period group was 47.3 percentage points more likely to be hospitalized during their index ED visit than the post-period group (77.7% versus 30.4%). The treatment group showed a higher rate of return to the ED within 90 days than did the comparison group (14.5% versus

2.8%), though this difference is not statistically significant. In total, the comparison group had higher unadjusted combined hospital/ED use than the treatment group (80.6% versus 37.7%).



Logistic regressions provide adjusted estimates of the differences between the two groups.

Table 2 uses multivariate logistic regression to assess whether any differences in observed descriptive characteristics for the treatment versus comparison groups. Consistent with the bivariate assessment in Table 1, the treatment and comparison groups did not differ significantly on any observed variables. However, although not significant, the physician-identified treatment (post-clinic availability) patients

were notably less likely to have AFib as a primary diagnosis and more likely to be insured by Medicare than were the physician-identified comparison patients. Therefore, it is important to control for these observed characteristics in the outcome analyses. However, given the relatively small sample size and limited time period for the study, these differences may be due to sampling error.

<b>Table 2: Multivariate Analysis of Descriptive Characteristics (n=105)</b>	
<b>Dependent Variable: Treatment (Index ED visit after July 1, 2015) versus Comparison Patient</b>	<i>Odds Ratio (95% CI)</i>
<b>Age</b>	0.99 (0.96, 1.04)
<b>Female</b>	0.74 (0.29, 1.88)
<b>White/Caucasian</b>	1.49 (0.43, 5.19)
<b>Case Mix Severity (Average SAF Score)</b>	0.79 (0.49, 1.28)
<b>AFib Primary Diagnosis</b>	0.29 (0.03, 2.81)
<b>Insured by Medicare</b>	1.71 (0.56, 5.19)
Constant	6.72 (0.21, 210.37)

Table 3 displays the results of the logistic regressions for my three dependent variables. For the first dependent variable (whether the patient was hospitalized during their index ED visit), the availability of the AFib Transitions Clinic showed a statistically significant protective effect, holding all other variables equal (OR=0.13, 95% CI: 0.05, 0.35). In addition, being insured by Medicare also had a statistically significant protective effect (OR=0.27, 95% CI: 0.08, 0.96). The female gender identity also had a protective effect against hospitalization during the index ED visit, while age and average SAF score did not have statistically significant associations. Age, average SAF score, or being female did not have statistically significant associations.

<b>Table 3: Logistic Regression Results on Follow-Up Visits and Any Hospitalizations (n=105)</b>			
<b>Dependent Variable</b>	Was patient hospitalized during index ED visit? <i>Odds Ratio (95% CI)</i>	Did patient return to hospital within 90 days? <i>Odds Ratio (95% CI)</i>	Combined ED/hospital use outcome. <i>Odds Ratio (95% CI)</i>
<b>Treatment (Post-AFib Transitions Clinic)</b>	<b>0.13 (0.05, 0.35)*</b>	6.06 (0.70, 52.13)	<b>0.16 (0.06, 0.42)*</b>
<b>Average SAF Score</b>	1.62 (0.99, 2.65)	0.71 (0.36, 1.42)	1.53 (0.95, 2.45)
<b>Female</b>	0.97 (0.35, 2.67)	2.87 (0.65, 12.63)	1.27 (0.48, 3.35)
<b>Age</b>	1.02 (0.97, 1.06)	1.02 (0.95, 1.09)	1.02 (0.98, 1.06)
<b>Insured by Medicare</b>	<b>0.27 (0.08, 0.96)*</b>	2.12 (0.26, 16.97)	0.38 (0.11, 1.28)
<b>Constant</b>	0.97 (0.07, 13.26)	0.00 (0.00, 0.57)*	0.59 (0.05, 7.41)

\*Significant at  $p < 0.05$

Neither treatment status or any of the independent variables had a statistically significant association with whether the patient returned to the ED within 90 days of their index ED visit. However, though insignificant, treatment patients in the post-period were substantially more likely to return to the ED, holding all else equal (OR=60.6, 95% CI: 0.70, 52.13). Figure 3 shows that the small number of patients who returned to the ED limits this analysis. Though not statistically significant, patients with higher average SAF scores were more likely to return to the ED within 90 days, as might be expected.

The third dependent variable reflects overall hospital use by observed patients; that is, the patient is coded as 1 if they were hospitalized during their index ED visit, had returned to the ED within 90 days of index visit, or hospitalized during an observed return visit. The availability of the AFib Transitions Clinic was associated with a substantial reduction in the likelihood of the combined outcome; a low- to moderate-risk patient visiting the ED during the post-period was substantially less likely to use the hospital or return than a pre-period comparison patient (OR=0.16, 95% CI: 0.06-0.42).

The estimated predicted probabilities and marginal effects from the availability of the AFib Transitions Clinic on my two dependent variables. Table 4 shows the predicted probabilities and marginal effects (estimated difference between the treatment and comparison groups) of the availability of the Transitions Clinic visit from the logistic regressions in Table 3.

<b>Table 4: Predicted Probabilities and Marginal Effects of the AFib Transitions Clinic</b>			
	Was patient hospitalized during index ED visit? (95% CI)	Did patient return to hospital within 90 days? (95% CI)	Combined ED/hospital use outcome. (95% CI)
<b>Predicted Probability Treatment Group (Post July 1, 2015)</b>	32.3% (21.6, 42.9)*	14.2% (6.3, 22.0)*	36.4% (25.3, 47.5)*
<b>Predicted Probability Comparison Group (Pre July 1, 2015)</b>	75.3% (61.1, 89.5)*	2.9% (-2.6, 8.5)	75.7% (61.5, 89.9)*
<b>Difference in Percentage Points (Treatment-Comparison)</b>	<b>-43 (-60.9, -25.1)*</b>	<b>11.3 (1.6, 20.9)*</b>	<b>-39.3 (-57.5, -21.2)*</b>

\*Significantly different from zero at  $p < 0.05$

An AFib patient during the post-period was much less likely to be hospitalized during their index visit (32.3% versus 75.3%). Treatment (post-period) patients had an increased likelihood of returning to the ED after the index visit relative to the comparison group (14.2% versus the 2.9%). The combined outcome shows net benefit of the availability of the Transitions Clinic, with 36.4% of post-period patients being hospitalized at the index ED visit or returning to the ED within 90 days versus 75.7% of pre-period patients. The estimated marginal effects are all statistically greater than zero, with a reduction of 39.3 percentage points for the combined outcome.

Table 5 shows the distribution of primary diagnoses among the observed return visits. Unfortunately, only 12 observations are available; among these twelve patients, only five of them returned due to their AFib, and the others returned for other reasons. Furthermore, only two observations occurred during the pre-implementation period (one of them returned for AFib). Further research and data collection are needed to better inform the primary reasons for patients returning to the hospital, and whether the post-implementation “treatment” patients actually visited the AFib Transitions Clinic.



<b><u>Table 5: Distribution of Primary Diagnosis Among 12 Patients with Return ED/Hospital Visits</u></b>		
<b>Primary Diagnosis on Return Visit Within 90 Days of Index ED Visit</b>	<b>Comparison (pre-period) Group</b>	<b>Treatment (post-period) Group</b>
<b>Atrial Fibrillation</b>	1	4
<b>Not Atrial Fibrillation</b>	1	6

### **Discussion**

The analysis supports the effectiveness of the AFib Transitions clinic for its goal of reducing hospital use. Specifically, the results are consistent with a substantial reduction in hospital use from a disease management clinic and its education program on self-management for patients with AFib. This finding is important because of the dearth of research on disease management clinics focused on AFib.

While it is concerning that the analysis showed that treatment (post-period) patients were more likely to return to the ED within 90 days of their index visit, two considerations temper this preliminary finding. First, this study was based on small samples, and the result might not be supported in a larger study. Second, some patients who seem suitable for referral to the AFib Transitions Clinic might need additional services to avoid a return to the ED if AFib was the primary reason for return. Therefore, additional scrutiny of this important issue using more data is warranted.

Several other limitations should be considered in addition to the small sample size. This pilot study assessed the experience of one inpatient setting and one clinic, so generalizability could be limited. Rather than having a randomized design, the treatment and comparison groups were identified by physicians as the type of patient appropriate for the clinic. The sample was predominantly white, and the time frame for the study did not allow tracking of outcomes beyond a 90 day follow-up period. A year-long follow-up period can capture returns by patients whose symptoms are not severe enough to

require a return within three months. The observational nature of the data meant that controlling for other variables that might affect outcomes was appropriate, but data on potentially important characteristics such as income or socio-economic status were not available at all, and data on some relevant clinical indicators such as blood pressure were not available. Without a study using a randomized design, it is not possible to say with certainty whether the results were directly or strongly affected by unmeasured differences between the groups.

Finally, the large decrease in hospital use (driven by the greater likelihood of discharge without hospitalization during the index ED visit) implies that the AFib Transitions Clinic likely reduces the total cost of care. Additional data on hospital days and ambulatory visits during the follow-up period could enable a cost-effectiveness analysis. Further research is needed to properly estimate the cost-effectiveness of a disease management clinic targeting patients with AFib emergency visits.

### **Conclusion**

Since this particular clinic is a pilot project, these early findings support efforts by the UNC team to replicate the Transitions Clinic at other facilities within the UNC Hospital system or to consider initiating a larger randomized trial. Further research is needed to better understand the full impact of disease management clinics by getting additional data including a larger sample, additional control variables, and more information on implementation and treatment costs of the Transitions Clinic as well as other ambulatory service use. These data would enable a broader study of cost-effectiveness.

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